

REMARKS

The Office Action of August 5, 2008, has been received and reviewed.

Claims 1-25 are currently pending and under consideration in the above-referenced application. Each of claims 1-25 has been rejected.

New claims 26-29 have been added.

Reconsideration of the above-referenced application is respectfully requested.

Rejections under 35 U.S.C. § 102

Claims 1-8, 10-13, 15-19, and 23-25 have been rejected under 35 U.S.C. § 102(e).

A claim is anticipated only if each and every element, as set forth in the claim, is found, either expressly or inherently described, in a single reference which qualifies as prior art under 35 U.S.C. § 102. *Verdegaal Brothers v. Union Oil Co. of California*, 2 USPQ2d 1051, 1053 (Fed. Cir. 1987). The identical invention must be shown *in as complete detail and in the same arrangement as that contained in the claim*. *Net Moneyin, Inc. v. Verisign*, __ F.3d __, __ (Fed. Cir. 2008); *Richardson v. Suzuki Motor Co.*, 9 USPQ2d 1913, 1920 (Fed. Cir. 1989).

Hudson

Claims 1-8, 10-13, 15-19, and 23-25 have been rejected under 35 U.S.C. § 102(e) for being drawn to subject matter that is purportedly anticipated by the subject matter described in U.S. Patent 5,972,792 to Hudson (hereinafter “Hudson”).

Independent claim 1, as amended and presented herein, recites a substantially abrasive-free slurry for use in polishing a copper structure of a semiconductor device. The slurry comprises a plurality of components, including at least one oxidizer and at least one inhibitor. The plurality of components is formulated to substantially concurrently polish copper and tungsten. The tungsten is removed at substantially the same rate as or at a slower rate than copper is removed.

It has been asserted that the formulation of a slurry is a functional limitation that need not be considered by the Office. Office Action of August 5, 2008, pages 3 and 4. The formulation

of a slurry, even when defined in terms of the results that may be achieved by use of the slurry, is a physical property of that slurry, not a functional limitation, and cannot be disregarded.

Even assuming, for the sake of argument, that the recitation by independent claim 1 of a slurry that will substantially concurrently polish copper and tungsten is a functional limitation, M.P.E.P. § 2173.05(g) clearly requires the Office to evaluate and consider functional limitations, “just like any other limitation of [a] claim, for what [they] fairly [convey] to a person of ordinary skill in the pertinent art in the context in which it is used.” Thus, even if the recitation of materials that may be removed by the claimed slurry is considered a functional limitation, since those limitations convey to one of ordinary skill in the art information about the slurry itself, they must be considered.

Hudson does not provide any express or inherent description of a slurry that is formulated to substantially concurrently polish copper and tungsten. Hudson discloses a number of different abrasive-free slurries that are useful with fixed-abrasive polishing pads. The slurries of Hudson are useful for planarizing films that have been formed from a variety of different materials. *See, e.g.*, col. 22-25. For example, Hudson describes one slurry that is useful for removing tungsten, but does not describe that slurry as also being useful for removing copper. Col. 4, lines 34-49. Instead, Hudson teaches that another, completely different slurry must be used to remove copper. Col. 4, lines 56-65. Nor does Hudson provide any express or inherent that the copper-removing slurry is useful for removing tungsten. *Id.* As the description of Hudson is limited to use of separate slurries with different formulations to remove tungsten and copper, it is apparent that neither the tungsten-removing slurry of Hudson nor the copper-removing slurry of Hudson is formulated to polish both tungsten and copper.

In rejecting claims 1-8, 10-13, 15-19, and 23-25, the Office has asserted, “[s]ince Hudson uses a composition that is substantially free of abrasives..., then using Hudson’s slurry in the same manner claimed in the present invention would inherently result in” the subject matter recited in each of claims 1-11 and 15-19. Final Office Action of April 11, 2008, page 2. Again, by describing the use of differently formulated slurries to remove tungsten and copper, it is apparent from Hudson that neither the tungsten-removing slurry described therein nor the copper-removing slurry described therein is formulated to remove both tungsten and copper.

In addition, in formulating a polishing slurry, a large number of factors determine the material or materials that the slurry will be useful for removing, as well as the rates at which the slurry will oxidize and/or remove each material. The disclosure of Hudson supports this point by pointing out that a slurry of one specific formulation and an accompanying set of properties will remove tungsten, while the removal of copper requires another slurry with a completely different formulation and significantly different properties. More specifically, the slurries of Hudson that are able to remove tungsten are weak acids (*e.g.*, have pHs of 4.5, or below 5.0) (col. 4, lines 34-41), while the slurries of Hudson that remove copper are not weak acids; they are either strongly acidic (*i.e.*, have pHs of less than approximately 2.5) or a strongly basic (*e.g.*, have pHs of more than approximately 10.5) (col. 4, lines 56-59). Further, there are significant differences in the components of the different slurries that are described in Hudson. The slurries of Hudson that remove tungsten include as oxidants one or more of ferric nitrate, hydrogen peroxide, potassium iodate, and bromine. Col. 4, lines 36-37. Completely different oxidants are used in the slurries of Hudson that remove copper: nitric acid and ethanol; nitric acid and benzotriazole; ammonium hydroxide; or ammonia ferricyanide. Col. 4, lines 60-65.

In view of the foregoing, contrary to the Office's assertions that there must be some slurry disclosed by Hudson that will remove both tungsten and copper (, it is apparent that Hudson does not provide any express or inherent description of any specific slurry that is formulated to (*i.e.*, with physical properties that will) remove both tungsten and copper.

Although Hudson mentions that a slurry formulated for the removal of tungsten may be used to planarize "a multi-level film stack with different metals (*e.g.*, titanium and aluminum on a tungsten plug) and a barrier layer (*e.g.*, titanium nitride)" (col. 4, lines 22-25), Hudson does not expressly describe a *single slurry* that is formulated to remove both copper and tungsten. Consequently, Hudson also lacks any express description of a slurry that removes tungsten at substantially the same rate or at a slower rate than copper is removed, as required by independent claim 1.

Nor has the Office met its burden of supplying extrinsic evidence, as set forth in M.P.E.P. § 2112, to support the assertion that any slurry disclosed in Hudson would necessarily remove copper and tungsten in the manner required by independent claim 1. Therefore, Hudson

does not inherently describe a slurry that removes tungsten at substantially the same rate or at a slower rate than copper is removed.

As such, it is respectfully submitted that Hudson does not anticipate each and every element of independent claim 1, as would be required to maintain the 35 U.S.C. § 102(e) rejection against amended independent claim 1.

Each of claims 2-8, 10-13, 15-19, and 23-25 is allowable, among other reasons, for depending either directly or indirectly from independent claim 1, which is allowable.

Claim 2 is also allowable since Hudson provides no express or inherent description of a slurry that is formulated for use with a polishing pad that includes fixed aluminum dioxide, titanium dioxide, silicon dioxide, or cerium dioxide abrasive particles.

Claim 3 is additionally allowable since Hudson neither expressly nor inherently describes a slurry that is formulated to oxidize copper at substantially the same rate as or at a faster rate than a barrier material is oxidized.

Claim 4 is further allowable because Hudson does not expressly or inherently describe a slurry in which copper and a barrier material have substantially the same oxidation energies.

Claim 5 depends from claim 4 and is also allowable since Hudson includes no express or inherent description of a slurry in which a barrier material has an oxidation energy of about 0.25 V more to about 0.20 V less than an oxidation energy of copper.

Claim 6 is further allowable since Hudson lacks any express or inherent description of a slurry in which a rate of removal of a barrier material is up to about ten times slower than a rate of removal of copper.

Claim 7 is additionally allowable because Hudson includes no express or inherent description of a slurry in which a rate of removal of a barrier material is about two to about four times slower than a rate of removal of copper.

Claim 8 is also allowable since Hudson neither expressly nor inherently describes a slurry that is formulated to remove copper and a barrier material without substantially dissolving barrier material that underlies remaining portions of copper.

Claim 15 is further allowable because the description of Hudson regarding a slurry that may have a pH of about 2 to about 6 is limited to a slurry that will remove copper (or aluminum).

Hudson does not provide any express or inherent description that a slurry with a pH of about 2 to about 6 will remove tungsten.

Withdrawal of the 35 U.S.C. § 102(a) rejections of claims 1-8, 10-13, 15-19, and 23-25 is respectfully solicited, as is the allowance of each of these claims.

Rejections under 35 U.S.C. § 103(a)

Claims 9, 14, and 20-22 are rejected under 35 U.S.C. § 103(a).

There are several requirements in establishing a *prima facie* case of obviousness against the claims of a patent application. All of the limitations of the claim must be taught or suggested by the prior art. *In re Royka*, 490 F.2d 981, 985 (CCPA 1974); *see also* MPEP § 2143.03. Even then, a claim “is not proved obvious merely by demonstrating that each of its elements was, independently, known in the prior art.” *KSR Int’l Co. v. Teleflex Inc.*, 82 USPQ2d 1385, 1396 (2007). The Office must also establish that one of ordinary skill in the art would have had a reasonable expectation of success that the purported modification or combination of reference teachings would have been successful. *In re Merck & Co., Inc.*, 800 F.2d 1091, 1097 (Fed. Cir. 1986). There must also be “an apparent reason to combine the known elements in the fashion claimed by the patent at issue.” *KSR* at 1396. That reason must be found in the prior art, common knowledge, or derived from the nature of the problem itself, and not based on the Applicant’s disclosure. *DyStar Textilfarben GmbH & Co. Deutschland KG v. C. H. Patrick Co.*, 464 F.3d 1356, 1367 (Fed. Cir. 2006). A mere conclusory statement that one of ordinary skill in the art would have been motivated to combine or modify reference teachings will not suffice. *KSR* at 1396.

Hudson in View of Nakazato

Claims 9 and 14 stand rejected under 35 U.S.C. § 103(a) for reciting subject matter which is assertedly unpatentable over that taught in Hudson as applied to claim 1 above, and further in view of teachings from U.S. Patent 4,459,216 to Nakazato et al. (hereinafter “Nakazato”).

Claims 9 and 14 are both allowable, among other reasons, for depending directly or indirectly from claim 1, which is allowable.

Moreover, it is respectfully submitted that Hudson teaches away from dissolving conductive material while oxidizing and polishing the same. Col. 4, lines 1-19, and col. 5, lines 55-64. In contrast, Nakazato teaches that “[a]n object of the present invention is to provide a chemical dissolving solution having a good dissolving capacity for various kinds of metal.” Col. 2, lines 33-35. In this regard, the mere fact that Nakazato supplies teachings that are missing from Hudson is insufficient to overcome the fact that Hudson teaches away from the asserted combination. As Hudson teaches away from the asserted combination of its teachings with those of Nakazato, it is respectfully submitted that one of ordinary skill in the art wouldn’t have been motivated to combine the teachings of these references in the asserted manner.

The Office asserts that the motivation for the combination of reference teachings has been derived from Nakazato, not Hudson. In so doing, the Office has ignored the requirement that references not be combined “where the references [in this case, Hudson,] teach away from their combination.” M.P.E.P. § 2146(X)(D)(2). The M.P.E.P. does not indicate that one the teachings of one source may be considered while the teachings of another reference are disregarded, as has been proposed by the Office at pages 4 and 5 of the Office Action of August 5, 2008.

Therefore, a *prima facie* case of obviousness has not been established against any of claims 12-14 and 21-25 under 35 U.S.C. § 103(a).

Hudson in View of Suzuki

Claims 20-22 stand rejected under 35 U.S.C. § 103(a) for reciting subject matter which is allegedly unpatentable over the subject matter taught in Hudson and, further, in view of teachings from U.S. Patent 5,885,334 to Suzuki et al. (hereinafter “Suzuki”).

Claims 20-22 are each allowable, among other reasons, for depending directly or indirectly from claim 1, which is allowable.

It is respectfully requested that the 35 U.S.C. § 103(a) rejections of claims 9, 14, and 20-22 be withdrawn, and that each of these claims be allowed.

New Claims

New claims 25-29 have been added. New claims 25-29 are dependent claims that recite specific slurry formulations. It is respectfully submitted that none of new claims 25-29 introduces new matter into the above-referenced application.

CONCLUSION

It is respectfully submitted that each of claims 1-29 is allowable. An early notice of theallowability of each of these claims is respectfully solicited, as is an indication that the above-referenced application has been passed for issuance. If any issues preventing allowance of the above-referenced application remain which might be resolved by way of a telephone conference, the Office is kindly invited to contact the undersigned attorney.

Respectfully submitted,



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